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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,290	04/19/2004	Kazuo Sato	252002US2CONT	9908

22850 7590 06/27/2005

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EXAMINER	
DIAMOND, ALAN D	

ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/826,290	SATO ET AL.	
	Examiner	Art Unit	
	Alan Diamond	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) *14-17* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13 and 18-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *05122004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-13 and 18-26 in the reply filed on April 1, 2005 is acknowledged. The traversal is on the ground(s) that "it is believed that the claims of the present application would have to be searched in a handful of sub-classes", and "since electronic searching is commonly performed, a search may be made of a large number of, or theoretically all, subclasses without substantial additional effort", and that "search and examination of the entire application would not place a serious burden on the Examiner, whereas it would be a serious burden on Applicants to prosecute and maintain separate applications." This is not found persuasive because the inventions of Groups I and II are distinct for the reasons set forth in paragraph 2 bridging pages 2 and 3 of the Restriction mailed March 7, 2005. In addition to the inventions being distinct, there is serious burden on the Examiner because (1) the inventions have acquired a separate status in the art as shown by their different classification, (2) the search required for Group II is not required for Group I. Thus, restriction for examination purposes is proper. This serious burden is present regardless of whether searching is done manually or electronically. Furthermore, whether or not there is a serious burden on Applicant to prosecute and maintain separate applications is not the standard for determining restriction.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 14-17 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or

linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on April 1, 2005.

Information Disclosure Statement

3. The information disclosure statement (IDS) filed July 28, 2004 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because a listing of the references, such as on a PTO-1449, is not of record for this IDS in the IFW file. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

Suggested Claim Language

4. In claim 19 at line 3, and in claim 22 at line 3, the term "type-layer" should be changed to "type layer".

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-13 and 18-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, at line 6, it is not clear how many continuous micron-size protrusions are to be encompasses by "many" micron-size protrusions. The same applies to dependent claims 26, 13, and 18-26.

Claim 3 is indefinite because it is not clear what absolute values are being used when the claim recites "difference of the absolute values" at line 6. It is not clear whether it is difference between the absolute value of the maximum value and the absolute value of the minimum value, or it is the absolute value of the difference between the maximum value and the minimum value. The same applies to dependent claims 4 and 18-26.

In claim 4, at each of lines 4 and 6, the open and close parenthesis should be removed so as to clearly set forth that the material surrounded by said parenthesis is part of the claim.

Claim 5 is indefinite because the term "small" at line 4 is relative and subjective. The same applies to dependent claims 7-12 and 18-26. In particular, said term also appears in claim 7, at line 2.

In claim 5, at lines 7-8, it is not clear how many continuous micron-size protrusions are to be encompasses by "many" micron-size protrusions. The same applies to dependent claims 7-12 and 18-26.

Claim 11 is indefinite because the term "the composition" at line 3 lacks positive antecedent support in claim 5. The same applies to dependent claim 12. It is suggested that "the" be removed from said term.

In claim 18, at line 2, it is not clear, in the photoelectric conversion element, what is to be encompassed by the term "via a photoelectric conversion layer". The same applies to dependent claims 19-26. It is suggested that claim 18 be rewritten as follows: "A photoelectric conversion element comprising the substrate with the transparent conductive oxide film as defined in any one of claims 1 to 13, a photoelectric conversion layer on the transparent conductive oxide film, and a rear face electrode on the photoelectric conversion layer."

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. Claims 1, 18, 19, and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 10-70294 A, herein referred to as JP '294.

As seen in Figures 1 and 3, JP '294 teaches a substrate (1) with a transparent conductive oxide film (4), wherein said substrate (1) with said transparent conductive oxide film (4) clearly has a plurality of ridges and a plurality of flat portions, wherein the surfaces of the ridges and the flat portions have many continuous protrusions, said protrusions having an average level difference, i.e., height D_2 seen in JP '294's Figure 2(c), of less than 0.5 microns, e.g., a height of 0.2 microns (see also paragraphs 0013, and 0024 to 0052).

With respect to claims 18, 19, and 22, a solar cell is prepared comprising said substrate (1), said transparent conductive oxide film (4), a photoelectric conversion layer comprising p-type, i-type and n-type layers (6, 7, 8) in this order, an electrode layer (9) that reads on the instant contact-improving layer, followed by a rear face metallic electrode layer (10) made from silver (see Figure 3; and paragraphs 0037 to 0052).

Since JP '294 teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

9. Claims 1, 18, 19, and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Shiozaki (U.S. Patent 5,977,477).

Shiozaki teaches a substrate (100) with a transparent conductive oxide (102), wherein said substrate (100) with the transparent conductive oxide (102) as seen in Figure 1 has a plurality of ridges and flat portions (see also col. 3, lines 5-32). For examples, a ridge is near the second vertical arrow from the left in said Figure 1, a flat portion is near the fifth vertical arrow from the left in said Figure 1, another ridge is near the seventh vertical arrow from the left in said Figure 1, and another flat portion is near ninth vertical arrow from the left in said Figure 1. Furthermore, as clearly seen in said Figure 1, said ridges and flat portions have continuous micron-size protrusions along the surface (103). Indeed, the distance between relative minimums (108) for the protrusions seen in Figures 1 and 1A is 2 microns or less (see also col. 2, lines 41-50).

With respect to claim 18, 19, and 22, a photovoltaic device is formed comprising said substrate (101), said transparent conductive oxide (102), and then n-type, i-type,

and p-type layers (104, 105, 106) (see Figure 1; and col. 5, lines 33-49). Instead of the nip junction, a pin junction can be used, in which case the p-type layer is deposited, then the i-type layer, and then the n-type layer (see col. 5, lines 33-49). After the nip or pin layers comes an indium tin oxide (ITO) layer (which reads on the instant contact-improving layer), followed by a collective electrode formed from silver paste (which reads on the instant rear face electrode) (see col. 5, line 51 through col. 6, line 19; and col. 7, lines 41-62).

Since Shiozaki teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 102/103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 3, 4, 13, 23, and 24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over JP 10-70294 A, herein referred to as JP '294.

As seen in Figures 1 and 3, JP '294 teaches a substrate (1) with a transparent conductive oxide film (4), wherein said substrate (1) with said transparent conductive oxide film (4) clearly has a plurality of ridges and a plurality of flat portions, wherein the surfaces of the ridges and the flat portions have many continuous protrusions, said protrusions having an average level difference, i.e., height D_2 seen in JP '294's Figure

2(c), of less than 0.5 microns, e.g., a height of 0.2 microns (see also paragraphs 0013, and 0024 to 0052).

With respect to claims 3, 4, and 13, it is the Examiner's position that JP '294's substrate (1) with transparent conductive oxide film (4), as prepared according to the detailed procedure set forth in paragraphs 0024 to 0052, inherently has the haze and difference in the absolute values between the maximum value and minimum value of the haze, as set forth in said claims 3, 4, and 13.

With respect to claims 23 and 24, a solar cell is prepared comprising said substrate (1), said transparent conductive oxide film (4), a photoelectric conversion layer comprising p-type, i-type and n-type layers (6, 7, 8) in this order, a 50 nm ZnO film as electrode layer (9) and that corresponds to the instant contact-improving layer, followed by a rear face metallic electrode layer (10) made from silver (see Figure 3; and paragraphs 0037 to 0052). It is the Examiner's position that JP '294's ZnO layer (9) inherently has a resistivity of not more than $1x10^{-2}$ $\Omega \cdot cm$ and an absorption coefficient of not more than $5x10^{3}$ cm^{-1} in a wavelength region of from 500 to 800 nm.

Since JP '294 teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

In addition, the instantly claimed haze, difference in of the absolute values between the maximum value and minimum value of the haze, resistivity, and absorption coefficient of not more than $5x10^{3}$ cm^{-1} in a wavelength region of from 500 to 800 nm, would obviously have been present once JP '294's solar cell is provided. Note In re

Best, 195 USPQ at 433, footnote 4 (CCPA 1977) as to the providing of this rejection under 35 USC 103 in addition to the rejection made above under 35 USC 102.

12. Claims 3, 4, 13, 23, and 24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Shiozaki (U.S. Patent 5,977,477).

Shiozaki teaches a substrate (100) with a transparent conductive oxide (102), wherein said substrate (100) with the transparent conductive oxide (102) as seen in Figure 1 has a plurality of ridges and flat portions (see also col. 3, lines 5-32). For examples, a ridge is near the second vertical arrow from the left in said Figure 1, a flat portion is near the fifth vertical arrow from the left in said Figure 1, another ridge is near the seventh vertical arrow from the left in said Figure 1, and another flat portion is near ninth vertical arrow from the left in said Figure 1. Furthermore, as clearly seen in said Figure 1, said ridges and flat portions have continuous micron-size protrusions along the surface (103). Indeed, the distance between relative minimums (108) for the protrusions seen in Figures 1 and 1A is 2 microns or less (see also col. 2, lines 41-50).

With respect to claims 3, 4, and 13, it is the Examiner's position that Shiozaki's substrates (100) with transparent conductive oxide (102), as prepared according to the detailed procedure set forth in Examples 1 to 4 at cols. 6 to 10, inherently have the haze and difference in the absolute values between the maximum value and minimum value of the haze, as set forth in said claims 3, 4, and 13.

With respect to claims 23 and 24, a photovoltaic device is formed comprising said substrate (101), said transparent conductive oxide (102), and then n-type, i-type,

and p-type layers (104, 105, 106) (see Figure 1; and col. 5, lines 33-49). Instead of the nip junction, a pin junction can be used, in which case the p-type layer is deposited, then the i-type layer, and then the n-type layer (see col. 5, lines 33-49). After the nip or pin layers comes an indium tin oxide (ITO) layer (which corresponds to the instant contact-improving layer), followed by a collective electrode formed from silver paste (which reads on the instant rear face electrode) (see col. 5, line 51 through col. 6, line 19; and col. 7, lines 41-62). It is the Examiner's position that Shiozaki's ITO layer prepared in Example 1 at col. 7, lines 41-57, and which contains 10 percent tin oxide and 90 percent indium oxide, inherently has a resistivity of not more than $1x10^{-2}$ $\Omega \cdot cm$ and an absorption coefficient of not more than $5x10^{3}$ cm^{-1} in a wavelength region of from 500 to 800 nm.

Since Shiozaki teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

In addition, the instantly claimed haze, difference in of the absolute values between the maximum value and minimum value of the haze, resistivity, and absorption coefficient of not more than $5x10^{3}$ cm^{-1} in a wavelength region of from 500 to 800 nm, would obviously have been present once the photovoltaic devices in Shiozaki's Examples 1 to 4 have been provided. Note In re Best, 195 USPQ at 433, footnote 4 (CCPA 1977) as to the providing of this rejection under 35 USC 103 in addition to the rejection made above under 35 USC 102.

Claim Rejections - 35 USC § 103

13. Claims 2, 20 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 10-70294 A, herein referred to as JP '294.

As seen in Figures 1 and 3, JP '294 teaches a substrate (1) with a transparent conductive oxide film (4), wherein said substrate (1) with said transparent conductive oxide film (4) clearly has a plurality of ridges and a plurality of flat portions, wherein the surfaces of the ridges and the flat portions have many continuous protrusions, said protrusions having an average level difference, i.e., height D_2 seen in JP '294's Figure 2(c), of less than 0.5 microns, e.g., a height of 0.2 microns (see also paragraphs 0013, and 0024 to 0052).

JP '294 teaches the limitations of the instant claims other than the differences which are discussed below.

With respect to claim 2, and as noted above, JP '294 exemplifies a protrusion height of 0.2 microns. JP '294 does not specifically teach the basal plane diameters of the protrusions and thus, does not teach the instant ratio of height to basal plane diameter for the protrusions. While it is acknowledged that JP '294's Figures 1 and 2 are schematics, they do show that the heights of the protrusions is roughly the same as the diameters. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared JP '294's substrate (1) with transparent conductive oxide film (4) such that the protrusions have height and diameters of, for example, 0.2 microns because JP '294 exemplifies a protrusion height of 0.2 microns, and shows that the heights of the protrusions is roughly the same as the

diameters. The Examiner notes that nothing unexpected has been demonstrated by applicant with respect to this ratio.

With respect to claims 20 and 25, a solar cell is prepared comprising said substrate (1), said transparent conductive oxide film (4), a photoelectric conversion layer comprising p-type, i-type and n-type layers (6, 7, 8) in this order, a 50 nm ZnO film as electrode layer (9) and that corresponds to the instant contact-improving layer, followed by a rear face metallic electrode layer (10) made from silver (see Figure 3; and paragraphs 0037 to 0052). JP '294 does not specifically teach that the silver in its rear face electrode is present in an amount of at least 95 mol%, or that the ZnO in its electrode layer (9) has at least 90 atomic % of the total metal component in the layer as Zn. In the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared JP '294's silver rear face electrode such that the silver is present in an amount of at least 95 mol% so that a silver electrode could be obtained. There is nothing unobvious about producing a silver electrode that is relatively pure in silver. Furthermore, in the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used relatively pure ZnO, e.g., such as a ZnO layer in which at least 90 atomic % of the total metal component in the layer is Zn, so that a working electrode layer (9) in JP '294 could be obtained.

14. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '294 as applied to claims 2, 20, and 25 above, and further in view of Yaba et al (WO 88/09265).

JP '294 is relied upon for the reasons recited above. JP '294 teaches that its substrate (1) is made from glass (see paragraphs 0003 and 004). JP '294 does not specifically teach that its glass substrate (1) with transparent conductive oxide film (4) has a sheet resistance of from 8 to 20 Ω/square and an optical transmittance of from 80 to 90% at 550 nm measured by an immersion liquid method. Yaba et al teaches a solar cell substrate comprising a glass substrate and a transparent electrically conductive layer formed thereon, wherein the sheet resistance is 30 Ω/square or less, such as 10 Ω/square (see page 3, lines 12-18; page 4, lines 15-30; and page 5, lines 24-33). The advantage of such a sheet resistance is the avoidance of ohmic losses in a large area substrate (see page 5, lines 26-33). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared JP '294's glass substrate (1) with transparent conductive oxide film (4) such that the sheet resistance is 30 Ω/square or less, such as 10 Ω/square, because such a sheet resistance provides the advantage of the avoidance of ohmic losses in a large area substrate, as taught by Yaba et al. The instant transmittance of from 80 to 90% would have been within the level of ordinary skill in the art particularly in view of the fact the glass and JP '294's transparent conductive film (4) are transparent.

15. Claims 21 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '294 as applied to claims 2, 20, and 25 above, and further in view of Matsuyama et al (U.S. Patent 6,072,117).

JP '294 as relied upon for the reasons recited above, teaches the limitations of claims 21 and 26, the difference being that JP '294 does not specifically teach that the

silver of its rear face electrode (10) contains 0.3 to 5 mol% of Pd or Au, or that the ZnO of its transparent electrode (9) contains Ga or Al in an amount of from 0.3 to 10 mol% based on the summation of Zn. Matsuyama et al teaches a photovoltaic device wherein the transparent electrode layer can be ZnO containing dopant such as Ga or Al (see col. 21, line 61 through col. 22, line 24). Matsuyama et al also teaches a collecting electrode that can be made from silver alloyed with gold (see col. 22, lines 37-54). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared JP '294's ZnO transparent electrode (9) so that it is doped with Ga or Al because this type of doping is conventional in the art, as shown by Matsuyama et al. The determination of an appropriate level of Ga or Al doping for the ZnO, such as 0.3 to 10 mol% as here claimed, would have been within the level of ordinary skill in the art. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared JP '294's rear face electrode (10) such that it is an alloy of silver with gold because such is conventional in the art, as shown by Matsuyama et al. The determination of an appropriate amount of gold to be added to silver to form the silver alloy, such as 0.3 to 5 mol% as here claimed, would have been within the level of ordinary skill in the art.

16. Claims 5 and 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '294 as applied to claims 2, 20, and 25 above, and further in view of JP 2001-176334 A (herein referred to as JP '334).

JP '294, as relied upon for the reasons recited above, teaches the limitations of claims 5 and 7-9, the difference being that JP '294 does not specifically teach the

instant discontinuous small ridges of a first oxide. JP '334 teaches a transparent conductive film for a solar battery, wherein the transparent conductive film comprises small discontinuous ridges (9) made of a first oxide (e.g., ITO) and a continuous layer (10) formed on said ridges and formed of a second oxide (e.g., ITO) (see Figure 2; and paragraphs 00005 to 0007 and 0013 to 0032).

With respect to claim 7, JP '334 teaches that said ridges are hemispherical having a diameter of 0.05 to 200 microns, which encompasses the diameter range of 0.2 to 2.0 microns in said claim 7 (see paragraph 0005).

With respect to claim 8, ITO contains SnO_2, and as noted above, ITO is used by JP '334 for said small discontinuous ridges (9).

With respect to claim 9, ITO contains both SnO_2 and In_2O_3, and as noted above, ITO is used for JP '334 continuous layer (10).

JP '334 teaches that the advantage of using said discontinuous ridges (9) and continuous layer (10) for the transparent conductive film is that a large short-circuit current is obtained and efficiency is improved (see paragraphs 0031 and 0032).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used JP '334's discontinuous ridges (9) and continuous layer (10) for the transparent conductive film (4) in JP '294's solar cell because the advantage of using said discontinuous ridges (9) and continuous layer (10) for the transparent conductive film is that a large short-circuit current is obtained and efficiency is improved, as taught by JP '334.

17. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '294 in view of JP '334 as applied to claims 2, 5, 7-9, 20, and 25 above, and further in view of Matsuyama et al (U.S. Patent 6,072,117).

JP '294 in view of JP '334, as relied upon for the reasons recited above, teaches the limitations of claim 10, the difference being that JP '334 does not specifically teach that its tin oxide is doped with fluorine. Matsuyama et al teaches the conventionality of doping either ITO or tin oxide with fluorine (see col. 22, lines 17-23). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have doped JP '334's tin oxide with fluorine because it is conventional in the art to do so, as shown by Matsuyama et al. The determination of an appropriate level of doping, such as 0.01 to 4 mole%, and conductive electron density, would have been within the skill of an artisan so as to prepare a transparent conductive layer.

18. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '294 in view of JP '334 as applied to claims 2, 5, 7-9, 20, and 25 above, and further in view of JP 8-78714 A (herein referred to as JP '714).

JP '294 in view of JP '334, as relied upon for the reasons recited above, teaches the limitations of claims 11 and 12, the difference being that JP '334 does not specifically teach a silicon dioxide layer between its discontinuous ITO ridges (9) and continuous ITO layer (10). However, the use of a layer containing silicon dioxide between transparent conductive layers of a photoelectric device is conventional in the art as shown by JP '714 (see Figure 1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided a layer containing

silicon dioxide between JP '334's discontinuous ITO ridges (9) and continuous ITO layer (10) because it is conventional in the art to use of a layer containing silicon dioxide between transparent conductive layers of a photoelectric device, as shown by JP '714.

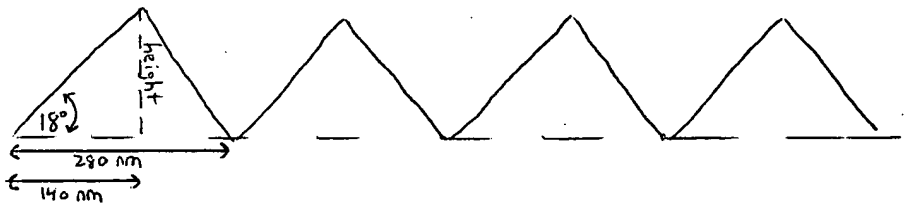
19. Claims 2, 20, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiozaki (U.S. Patent 5,977,477).

Shiozaki teaches a substrate (100) with a transparent conductive oxide (102), wherein said substrate (100) with the transparent conductive oxide (102) as seen in Figure 1 has a plurality of ridges and flat portions (see also col. 3, lines 5-32). For examples, a ridge is near the second vertical arrow from the left in said Figure 1, a flat portion is near the fifth vertical arrow from the left in said Figure 1, another ridge is near the seventh vertical arrow from the left in said Figure 1, and another flat portion is near ninth vertical arrow from the left in said Figure 1. Furthermore, as clearly seen in said Figure 1, said ridges and flat portions have continuous micron-size protrusions along the surface (103). Indeed, the distance between relative minimums (108) for the protrusions seen in Figures 1 and 1A is 2 microns or less (see also col. 2, lines 41-50).

Shiozaki teaches the limitations of the instant claims other than the differences which are discussed below.

With respect to claim 2, and as seen in Example 2, said relative distance between minimums (108) is 280 nm, i.e., 0.28 microns. This 0.28 microns corresponds to the instant basal plane diameters of the protrusions. The protrusions have a mean value of tilt angles (113) of 18° (see col. 8, line 34). Thus, the average or mean height of Shiozaki's protrusions can be estimated from the equation tan (18°) = height/ (140

nm), i.e., the mean or average height of irregularities is approximately 45 nm. The equation tan (18°) = height/ (140 nm) is obtained from Shiozaki's triangular-shaped protrusions as follows:



Thus, in said Example 2, the instant height/basal plane diameter ratio is 45/280 = 0.16. However, Shiozaki is not limited to this value. Indeed, Shiozaki is not limited to a tilt angle of 18°, and teaches that, in general, the tilt angle is 5° or more. In Example 4, the tilt angle is 20°, the relative distance between minimums is 280 nm, and thus, the instant ratio is 0.18. When, for example, a tilt angle of 55° is used, and the relative distance between minimums is 280 nm, then the instant ratio is 0.71. Shiozaki differs from instant claims 2 in that Shiozaki does not specifically teach that said ratio can be 0.7 to 1.2. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Shiozaki's substrate (100) with transparent conductive oxide (102) such that the tilt angle is 55° and the relative distance between minimums is 280 nm because such is within the scope of Shiozaki's disclosure. As noted above, Shiozaki is not limited to a tilt angle of 18°, and teaches that, in general, the tilt angle is 5° or more. The 5° or more encompasses, for example, said 55°.

With respect to claim 20, a photovoltaic device is formed comprising said substrate (101), said transparent conductive oxide (102), and then n-type, i-type, and p-type layers (104, 105, 106) (see Figure 1; and col. 5, lines 33-49). Instead of the nip

junction, a pin junction can be used, in which case the p-type layer is deposited, then the i-type layer, and then the n-type layer (see col. 5, lines 33-49). After the nip or pin layers comes an indium tin oxide (ITO) transparent electrode layer (which reads on the instant contact-improving layer), followed by a collective electrode formed from silver paste (which corresponds to the instant rear face electrode) (see col. 5, line 51 through col. 6, line 19; and col. 7, lines 41-62). Shiozaki differs from claim 20 in that Shiozaki does not specifically teach that the silver in its collective electrode is present in an amount of at least 95 mol%. In the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Shiozaki's silver collective electrode such that the silver is present in an amount of at least 95 mol% so that a silver electrode could be obtained. There is nothing unobvious about producing a silver electrode that is relatively pure in silver.

With respect to claim 25, in place of ITO for the transparent electrode layer (instant contact-improving layer), Shiozaki teaches that ZnO can be used (see col. 5, lines 52-67). Shiozaki differs from claim 25 in that Shiozaki does not specifically teach that when ZnO is used, at least 90 atomic % of the total metal component in the layer is Zn. However, in the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used relatively pure ZnO, e.g., such as a ZnO layer in which at least 90 atomic % of the total metal component in the layer is Zn, so that a working transparent electrode in Shiozaki could be obtained.

20. Claims 21 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiozaki as applied to claims 2, 20, and 25 above, and further in view of Matsuyama et al (U.S. Patent 6,072,117).

Shiozaki, as relied upon for the reasons recited above, teaches the limitations of claims 21 and 26, the difference being that Shiozaki does not specifically teach that the silver in its collective electrode contains 0.3 to 5 mol% of Pd or Au, or that said ZnO contains Ga or Al in an amount of from 0.3 to 10 mol% based on the summation of Zn. Matsuyama et al teaches a photovoltaic device wherein the transparent electrode layer can be ZnO containing dopant such as Ga or Al (see col. 21, line 61 through col. 22, line 24). Matsuyama et al also teaches a collecting electrode that can be made from silver alloyed with gold (see col. 22, lines 37-54). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Shiozaki's ZnO transparent electrode so that it is doped with Ga or Al because this type of doping is conventional in the art, as shown by Matsuyama et al. The determination of an appropriate level of Ga or Al doping for the ZnO, such as 0.3 to 10 mol% as here claimed, would have been within the level of ordinary skill in the art. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Shiozaki's collective electrode such that it is an alloy of silver with gold because such is conventional in the art, as shown by Matsuyama et al. The determination of an appropriate amount of gold to be added to silver to form the silver alloy, such as 0.3 to 5 mol% as here claimed, would have been within the level of ordinary skill in the art.

Conclusion

21. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patents 6,750,394, 6,787,692, and 6825408 are hereby made of record.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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June 21, 2005